420 FAMILY
OF
ISOLATING SIGNAL CONDITIONERS

420 TW SERIES

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Industrial Interface Research Limited 2002

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1.0 INTRODUCTION

The 420 TW series is a family of isolated two wire 4 - 20 mA transmitters capable of accepting a variety of electrical input types and operating with an output loop voltage of 12 to 32 V DC.

The input signal is the only parameter required to define any unit exactly. This information, together with a unique serial number, is printed on the side label of each unit; records of the exact configuration of every product shipped are maintained at the factory.

1.1 Input Types and Ranges

420 TW - HL (Previously designated 420 TW - 0 / 420 TW - 1)

Accepts either voltage or current (i.e. high level) inputs. The standard default configuration of the unit allows 4 - 20 mA, 0 - 20 mA, 2 - 10 V or 0 - 10 V inputs to be reconfigured by the user. However a much wider range of inputs is available to order.

In general the limits on signals that can be handled with the accuracy specified in Section 7 are:

Input Types	Input range MIN	Input range MAX	Notes
DC Current	0 - 100μA	0 - 5 A	
DC Voltage	0 - 100mV	0 - 100 V	Use 420 TW-TC for V in < 100mV
AC Current	0 - 200μA RMS	0 - 5 A RMS	$45_{HZ} \leq$ f in
AC Voltage	0 - 200mV RMS	0 - 70 V RMS	$45_{HZ} \leq$ f in

Standard process ranges such as 0 - 5 V or 1 - 5 V are of course covered.

420 TW - TC (Previously designated 420 TW - 2)

Accepts inputs directly from the following thermocouple types: E,T,K,T,N,R,S,F. Temperature ranges from 0 - 100 ^{o}C to 0 - 2000 ^{o}C can be reconfigured (mV outputs without cold junction compensation can be catered for to special order). All specified ranges are 0 ^{o}C referred, although negative inputs will not damage the unit. Automatic cold junction compensation is provided. Either upscale or downscale output drive, on sensor wire break detection, can be selected. The output is not linearized. Although any thermocouple type can be selected for any temperature range, the table below indicates the ranges for which the accuracy specified in section 7 is achieved:

INPUT TYPE	FULL SCALE INPUT		NOTES
	MIN	MAX	
mV	4mV	100mV	Special order:CJC not fitted
J(L)	80^{o}C	1200 ^{o}C	
K	100 ^{o}C	1372 ^{o}C	
T(U)	95 ^{o}C	400 ^{o}C	
E	65 ^{o}C	1000 ^{o}C	
N	150 ^{o}C	1300 ^{o}C	
R	460 ^{o}C	1768 ^{o}C	
S	480 ^{o}C	1760 ^{o}C	
F	100 ^{o}C	1400 ^{o}C	

2.0 UNPACKING

Please inspect the instrument carefully for signs of shipping damage. The unit is packaged to give maximum protection but we can not guarantee that undue mishandling will not have damaged the instrument. In the case of this unlikely event, please contact your supplier immediately and retain the packaging for our subsequent inspection.

2.1 Checking the Unit Type

Each unit has a unique serial number label (fig.1 below) on which full details of the configuration are given. These details should be checked to ensure conformance with your requirement.

Industrial Interface CE

PART NUMBER	420-TW
INPUT	4-20mA
OUTPUT	4-20mA
SUPPLY	OUTPUT LOOP
OPTIONS	
SERIAL No.	TW-000135

Fig. 1 - Serial Number Label

Fig. 2 - Front Panel Label

3.0 CONNECTIONS

Before proceeding, please check the information on the serial number label on one side of the unit to ensure that the unit configuration is correct (see Fig. 1 above). Connection details are given on the front panel label of the unit, adjacent to the relevant connections (see Fig. 2 above).

3.1 Loop Supply Voltage

The voltage across the output loop terminals must not exceed 32V DC - otherwise damage to the instrument may result. The unit is protected against reverse polarity connection.

4.0 RECONFIGURING THE INSTRUMENT (applies to reconfigurable units only)

In many cases the instrument will have been factory configured to the required specifications, and calibrated, in which case this section can be ignored.

If a particular configuration is not specified then the default (specified below) will be supplied.

4.1 Input Configuration

This section details the steps required to reconfigure the unit, after which recalibration will be necessary.

420 TW-HL

Current or voltage input can be selected to achieve any of the following DC inputs:

0-20mA
4-20mA
0-10V
2-10V

(If the input is not specified at the time of order the default configuration of 4 - 20 mA will be set).

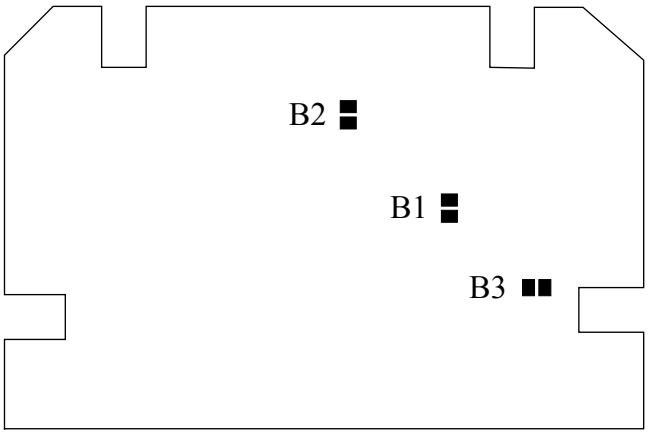


Fig.3 - Solder Bridge Link Selection Of Input Range

To reconfigure the instrument remove the side cover without the serial number label from the unit - this cover is a push fit and can be prised off with a thumb nail or small screwdriver. The three links B1,B2,B3, should be open or short circuit according to the following table:

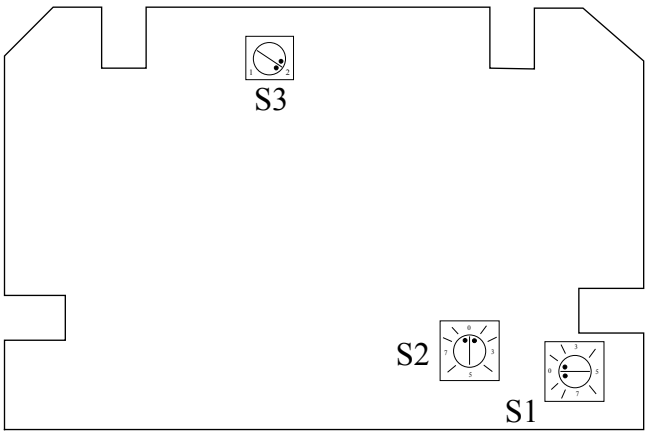
Input Range	B1	B2	B3
0 - 20 mA	Short	Short	Short
4 - 20 mA	Short	Short	Open
0 - 10 V	Open	Open	Short
2 - 10 V	Open	Open	Open

WARNING: TAKE GREAT CARE NOT TO DAMAGE THE DELICATE COMPONENTS ADJACENT TO THE LINKS.

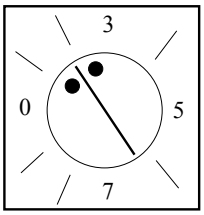
After reconfiguration replace the side cover.

420 TW-TC

Thermocouple type, range and wire break detect action are all user reconfigurable. (If the input is not specified at the time of order the default configuration of type K, 0 - 100°C, up scale will be set).



S1 - Thermocouple Type

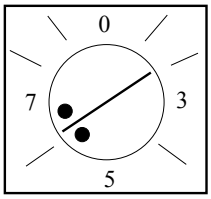


N.B. Only Switch Position '0' Is Marked.
Rotate Clockwise To Increment Position.

(Diagram above shown in position 2)

Switch Position	T/C Type
0	E
1	J
2	K
3	T
4	N
5	-
6	R
7	S
8	F
9	-

S2 - Range (0°-Full Scale)

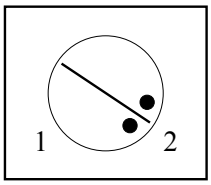


N.B. Only Switch Position '0' Is Marked.
Rotate Clockwise To Increment Position

(Diagram above shown in position 6)

Range (Full Scale)	Switch Position
100 - 115	0
115 - 145	1
-	2
145 - 190	3
190 - 275	4
275 - 500	5
500 - 2000	6

S3 - Burnout



Drive	Switch Position
Downscale	1 (Fully Anticlockwise)
Upscale	2 (Fully Clockwise)

(Diagram above shown in position 2)

Fig.4 - Switch Selection Of Input Type, Range & Burnout (Break Detect)

To reconfigure the instrument remove the side cover without the serial number label from the unit - this cover is a push fit and can be pushed off with a thumb nail or small screwdriver. Set the three switches S1,S2,S3 to the desired positions and replace the side cover.

5.0 RECALIBRATION

All units are factory calibrated; although the user may wish to recalibrate with greater frequency, a two yearly recalibration interval is adequate for most applications.

In the case of reconfigurable units, recalibration must be carried out after any change of configuration.

5.1 420 TW - HL

With appropriate input values use front panel zero and span pots to obtain desired zero scale and full scale voltage or current output (preferably with the actual circuit loop voltage and load resistance, for greatest accuracy). It may be necessary to repeat each adjustment to ensure correct calibration.

5.2 420 TW-TC

To recalibrate the unit a thermocouple simulator, (or for critical applications a millivolt source and ice-point reference) 24V DC power supply and accurate milliammeter/DMM are required:

1) Connect the equipment as shown in figure 5.

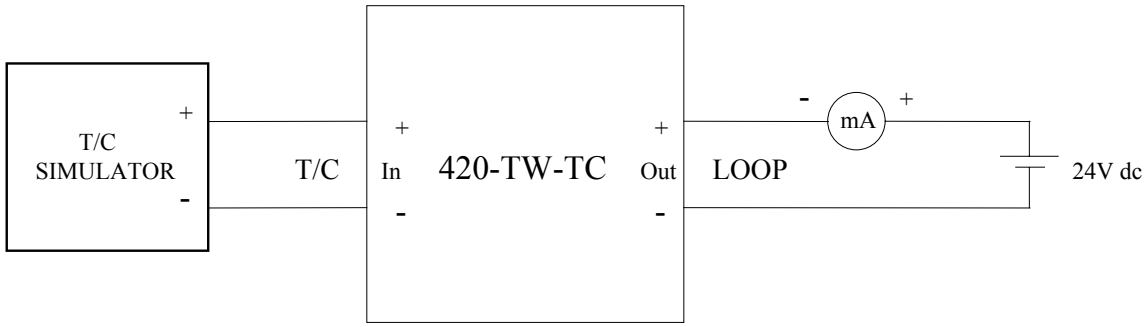
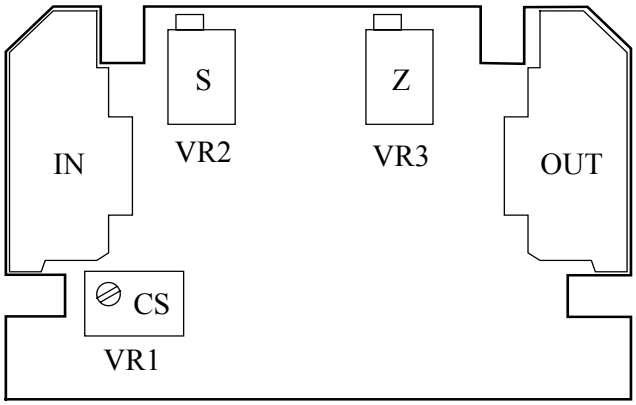


Fig. 5 - Calibration Circuit

Note that if a T/C simulator with automatic internal cold junction compensation is used, thermal equilibrium between the simulator and the 420 TW-TC must be established. In any case the compensation applied to the simulator must be equal to the 420 TW-TC input terminal temperature.



S = SPAN POT (VR2)

Z = ZERO POT (VR3)

CS = COARSE SPAN POT (VR1)

Fig. 6 - Adjustment Potentiometers

2) Referring to Figure 6, if configuration has been changed coarse range potentiometer, CS, must first be adjusted (to access VR1, remove the side cover with serial number label).

(i) Set input to full scale
(ii) Turn span potentiometer fully anti-clockwise to obtain minimum output current. Then adjust 6 turns clockwise
(iii) Adjust CS to give nominal 20mA output (19mA<output>21mA)

3) (i) Set input to zero and adjust zero potentionmeter (marked Z on circuit board) to give 4mA
(ii) Set input to full scale and adjust span potentionmeter (marked S on circuit board) to give 20mA
(iii) Repeat (i) and (ii) as necessary

6.0 INSTALLATION

6.1 Installation onto Rails

The instrument is designed to mount directly onto either the "Top hat" TS35 standard assembly rail to DIN 46277 part 3/EN 50022/BS5584, or the asymmetrical 32mm G-rail to DIN 46277 part 1/EN50035/BS5825.

6.2 Mounting Arrangements

Ideally the unit should be mounted in a vertical position, i.e. on a horizontal rail. This is the optimum orientation to minimise temperature rise within the unit. However successful operation is possible in any orientation.

Ensure the maximum ambient temperature is less than 70°C.
Good airflow around the unit will maximise reliability.

6.3 Wiring Precautions

The unit can accept a variety of sensor inputs, some of which produce very small signals. Therefore it is advisable to adhere to the following rules of good installation practice.

(i) Do not install close to switchgear, electromagnetic starters, contactors, power units or motors.

(ii) Do not have power or control wiring in the same loom as sensor wires.

(iii) Use screened cable for sensor wiring with the screen earthed at one end only.

(iv) Take care not to allow cut pieces of wire to fall onto the unit as they might enter via the ventilation holes and cause electrical short circuits. if in doubt, remove the units from the rail until wiring is complete.

(v) Use bootlace ferrules on all bare wires.

IMPORTANT: The connection terminals are designed for a maximum torque of 0.4Nm. Exceeding this figure is unnecessary and will result in unwarrantable damage to the unit.

7.0 SPECIFICATIONS

All specifications are at 20°C operating ambient with 250Ω output load and 24V loop voltage unless otherwise stated.

Accuracy and Response

420 TW-HL

Calibration accuracy at zero and full scale	+/- 0.05% full scale
Linearity	+/- 0.1% full scale
Zero drift	+ / - 50ppm full scale /°C
Gain drift	+/- 100ppm /°C
Gain dependence on load resistance, R_L	+/-5ppm / Ω, $0 \leq R_L \leq 600\Omega$
Response Time (90% of step change)	30ms typical
Output loop voltage range (R_L=O)	10 to 32V DC
Max Input Voltage drop (20mA input)	0.3V
Input impedance (0 - 10 V input)	1MΩ

420 TW-TC

Calibration accuracy at zero and full scale	+/- 0.2% full scale
Cold junction compensation accuracy	+/- 2 °C over operating temperature range
Linearity (with respect to thermocouple voltage)	+/- 0.1 % full scale
Zero Drift	+/- 50ppm full scale /°C
Gain Drift	+/- 100ppm /°C
Gain dependence on load resistance, R_L	+/-5ppm / Ω,$0 \leq R_L \leq 600\Omega$
Response time (90% of step change)	300ms typical (higher speed version available)
Output loop voltage range (R_L=O)	11 to 32 V DC
Sensor break detect current	+/- 250nA

Power Supply Isolation and Operating Ambient (all types)

Operating Voltage	11 - 32 V DC
Current	29 mA maximum overscale
Input to output isolation	1kV DC
Operating temperature range	-15 - 70°C
Storage temperature range	-40 - 100°C
Operating and storage humidity range	0 - 90% RH

7.1 EMC performance

420 TW-HL

The 420 TW-HL conforms with the protection requirements of Council Directive 89/336/EEC on the approximation of the laws of members states relating to electronic compatibility (Article 10 (1)):

1) Radiated Emissions:

The unit meets EN55011: 1991 (Group 1, Class B)
and EN55022: 1987 (Class B)

2) EMC Immunity:

The unit meets EN50082-2: 1995 as follows:

(i) ESD Immunity: Performance is not degraded by 8 KV ESD to ground in the vicinity of the unit. Direct ESD greater than 4 KV to the connection terminals or adjustment pots of the unit should be avoided. IMPORTANT: Service/ Maintenance personnel should take care to discharge themselves to the control cabinet/ systems earth before wiring, adjusting or calibrating the unit.

(ii) RF Immunity: The output of the unit varies by less than +/- 1% full scale with fields of $10Vm^{-1}$ with 80% A.M. at $1KH_Z$, between 800KHz and 1 GH_Z with any field orientation.

(iii) Fast Transient Immunity: During transients of 2 KV the outputs are temporarily affected and may vary by up to 1% full scale.

Hence the unit is suitable for both “Light industrial” and “Industrial” environments.

420 TW-TC

The 420 TW-TC conforms with the protection requirements of Council Directive 89/336/EEC on the approximation of the laws of members states relating to electronic compatibility (Article 10 (1)):

1) Radiated Emissions:

The unit meets EN55011: 1991 (Group 1, Class B) and EN55022: 1987 (Class B)

2) EMC Immunity:

The unit meets EN50082-1: 1992 as follows:

(i) ESD Immunity: Performance is not degraded by 8 KV ESD to ground on the vicinity of the unit. Direct ESD greater than 4 KV to the connection terminals or adjustment pots of the unit should be avoided. IMPORTANT: Service/ Maintenance personnel should take care to discharge themselves to the control cabinet/ systems earth before wiring, adjusting or calibrating the unit.

(ii) RF Immunity: The output of the unit varies by less than +/- 1% full scale with fields of $3Vm^{-1}$ CW between 800KHz and 500 MHz with any field orientation.

(iii) Fast Transient Immunity: During transients of 500V the output varies by less than +/- 1% full scale

Hence the unit is suitable for the “Light industrial” environment.